How quickly can you detect it? Power facilitates attentional orienting

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Abstract

This study investigated how power impacts the ability to orient attention across space. Participants were assigned to a high power or control role and then performed a computerised spatial cueing task in which they were required to direct their attention to a target that had been preceded by either a valid or invalid location cue. Compared to participants in the control condition, power-holders were better able to override the misinformation provided by invalid cues. This advantage occurred only at 500 ms stimulus onset asynchrony (SOA), whereas at 1000 ms SOA, when there was more time to prepare a response, no differences were found. These findings are taken to support the growing idea that social power affects cognitive flexibility.

Keywords: power, attention orienting, spatial cueing task, cognitive flexibility

Social power affects the way in which information is attended and discriminated (Fiske, 1993; Guinote, 2007a). Power holders have more resources and fewer constraints which gives them more attentional resources and allows them to discriminate between relevant and irrelevant information (Guinote, 2007a; Overbeck & Park, 2001). In contrast, powerless people face more constraints and environmental threats (Keltner, Gruenfeld, & Anderson, 2003). Their dependency encourages them to attend to multiple cues in the environment, in search of any potentially useful information. Thus, they treat information more equally, attending not only to the central information but also to the peripheral or distracting information (Slabu & Guinote, 2010). This overflow in information processing makes powerless people less able to respond promptly to specific situational demands, and induces attentional inflexibility (Guinote, 2007a).

Research using basic cognitive paradigms supports these claims. For example, Guinote (2007b) showed that high power participants are better able to focus their attention to target objects and ignore the influence of irrelevant background distracters (see also Smith & Trope, 2006). A further outcome of the cognitive flexibility experienced by powerful individuals is the increased ability to adjust their actions in line with changing contextual cues. This includes the ability to suppress dominant responses and implement non-dominant ones when the task calls for non-dominant responses (Guinote, 2007b).

The present research aims to further explore how power affects attentional processing. In particular, we focused on how power affects attentional orienting. Orienting is the process by which the attentional spotlight is moved to a specific location in space, a process induced either automatically by a salient exogenous cue such as an unexpected flash, or voluntarily according to the current behavioural goal. Orienting can be distinguished from other aspects of attentional control that are more concerned with either maintaining a general state of vigilance, or planning and selecting a specific goal while inhibiting and updating others (sometimes referred to as executive functions). Physiological evidence for this tri-partite system of attentional control is provided by functional MRI which shows that orienting, vigilance and executive control are each associated with discrete patterns of brain activity (Fan, McCandliss, Fossella, Flombaum, & Posner, 2005; Posner, Rueda, & Kanske, 2007; Wright & Ward, 2008). Although the effects of social power on orienting and vigilance have received little attention, mounting evidence suggests that power affects executive processing. For example, several studies have shown that having power increases the ability to resolve conflicts and plan action sequences; power-holders are immune to stimulus-response compatibility effects, and are better able to switch attention between the holistic and detailed components of stimuli, as changing task demands dictate (Guinote, 2007b; Smith, Jostmann, Galinsky, & van Dijk, 2008). However, no studies have shown that power affects the more rudimentary process of orienting, a skill fundamental to many daily activities.

One conventional means of exploring attentional orienting is via Posner’s spatial cueing task. Participants are asked to indicate, as quickly as possible, the whereabouts of a predefined target on a computer screen. The target is preceded by a cue which indicates the likely location of the upcoming target. On ‘valid’ trials, the cue accurately indicates the location of the target while on ‘invalid’ trials it cues attention to another location. This simple task is taken to tap three distinct aspects of attentional orienting; *disengagement*, *shift* and *engagement* (Posner & Cohen, 1984; Posner, Walker, Friedrich, & Rafal, 1984). While valid trials simply require attention to engage the target, invalid trials require attention to be first disengaged from the anticipated target location and then shifted to the actual location before being re-engaged. Accordingly, invalid cues typically invoke a cost in reaction time, the magnitude of which can be enhanced by either increasing the proportion of valid to invalid trials and thus altering participant's reliance on the cue or reducing the time between cue onset and target onset.

Because powerful people control their outcomes (Fiske, 1993), they have less restrictions and face less interference from others, which allows them to concentrate their cognitive resources to the task at hand. This greater cognitive capacity relates to a greater ability to control attention and avoid distractions (i.e., invalid cues). Given the greater attentional control and greater cognitive flexibility of powerful individuals, one might expect them to be less affected by invalid cues when orienting their attention than those individuals who find themselves in less powerful positions. More so, any such effect may be magnified as the time between cue offset and target onset decreases; at relatively short stimulus onset asynchronies (SOAs) (i.e. 500ms), the cognitive flexibility of powerful individuals is most likely to come to the fore as there is relatively little time with which to prepare responses for the unexpected occurrence of an invalid trial. At considerably longer SOAs (i.e. 1000 ms) much more time is available to prepare for this outcome and accordingly, less powerful people may be better able to compensate for their cognitive inflexibility. That is, they now have the time needed to prepare two potential responses – one if the cue proves to be valid, and one if it is invalid. As a consequence, any effects of social power on spatial cuing may be smaller at longer compared to shorter SOAs.

With these issues in mind, we therefore conducted a simple exogenous cueing experiment comprising valid and invalid trials with SOAs of 500 ms and 1000 ms. We predicted that high power participants, compared to control participants, would be especially advantaged for invalid trials that incorporated a short SOA.

Method

Participants

Fifty-eight students from the University of Kent, UK, participated in the experiment in exchange of course credits. Ten participants were dropped: four because of an error with the program, four for not following the instructions and two because of exceptionally high error rates (i.e., higher than 3 standard deviations). This left 48 participants (41 females) for the analyses, with an age between 18 and 27 years (*M* = 19.09, *SD* = 1.54).

Procedure

Upon arrival, participants were informed that they would work on two independent studies. The first study involved the power manipulation, which was adapted from Fiske and Dépret (1996). Participants were asked to decide whether a lecture theatre should be converted into a new studio. Those in the powerful condition read that their opinion will account for 40% of the final decision; whereas participants in the control condition were told that their opinions will not have any impact on the final decision made by the university.

The second study was the spatial cueing task as seen in Figure 1. As a means of centralising gaze, participants had to first verbally report a digit appearing in the middle of the screen (responses were not recorded). After an interval of 17 ms, the cue was signalled by one of the peripheral squares turning bright yellow for 200 ms. The cue was valid 64% of the time or invalid 16% of the time. To check for cue responding, the remaining 20% of trials were catch trials (with no cue displayed). The target then appeared, in random order but the same number of times, in either the left or right box. The interval (i.e., SOA) between cue and target was either 500 ms or 1000 ms, the order of which was again randomised, though, both SOAs occurred with the same frequency. Participants were instructed to say out loud the number and then indicate the location of the target (i.e., asterisk) as quickly and accurately as possible. Instructions also emphasized that they should keep their eyes fixed on the middle of the screen at all times. Responses were made by pressing one of two keys (target left: “1”, target right: “5”) with the index and middle finger of the dominant hand placed on the response box keys. Reaction time (RT) was measured in milliseconds from target onset until the participant's key press. Each participant was presented with 200 trials.

After the cueing experiment, participants were asked to rate their mood (Forgas, 1994) on four 7-point scales ranging from –3 (*very bad*; *very sad*; *very discontent*; *very tense*) to 3 (*very good*; *very happy*, *very content*; *very relaxed)*, and complete a self-efficacy questionnaire (Schwarzer & Jerusalem, 1995) to rule out the possibility that mood and self-efficacy might mediate the effects of power on invalid trials. Finally, participants were debriefed and thanked.

Results

Data Preparation

In line with previous cueing studies (Koster, De Raedt, Goeleven, Franck, & Crombez, 2005), RTs of less than 200 ms were treated as guesses and RTs greater than 750 ms were considered as non-responses and were eliminated from consideration (2.8 %). Also, RTs deviating more than 3 *SD*s from the individual mean were excluded (1.4 %) in order to control for univariate outliers. Trials with errors (1.2%) and catch trials were discarded from analysis; however, power did not impact erroneous responses or catch trials, ts < 1. Statistical analyses were run on 94.6 % of the data. The response times were log-transformed (natural logarithm function) to correct for skewness and mean RTs were calculated for each experimental condition.

Overall effects

No significant effects were found when gender was included in the analysis, so this factor was discarded from further investigation. The mean RTs were subjected to a 2 (power: powerful, control) x 2 (cue type: valid, invalid) x 2 (SOA: 500, 1000 ms) mixed-design analysis of variance (ANOVA) with power as the between-subjects factor. Two significant main effects emerged: for SOA, $F(1,46) = 79.83$, $p < .001$, $\eta^2 = .63$, with shorter responses following the 1000 ms SOA (*M* = 367) relative to 500 ms (*M* = 390); and for cue type, $F(1,46) = 38.84$, $p < .001$, $\eta^2 = .46$, with shorter responses for valid (*M* = 365) than invalid trials (*M* = 393).

The SOA x Power interaction also reached significance, $F(1,46) = 7.58$, $p < .008$, $\eta^2 = .14$, while the three-way interaction between Cue Type x SOA x Power approached significance, $F(1,46) = 3.92$, $p = .05$, $\eta^2 = .08$. No other reliable effects emerged (*F*s < 1.60).

Given that our predictions emphasised the role of SOA in moderating any effect of power, the three-way interaction was broken down into two separate ANOVAs for the two different SOAs (500 and 1000 ms). Mean RTs and standard deviations for this interaction are shown in Table 1.

500 ms SOA

For the short SOA condition, a 2 (cue type: valid, invalid) x 2 (power: powerful, control) mixed model analysis of variance (ANOVA), with power as the between-subjects variable revealed a significant main effect for cue type, $F(1,46) = 45.07$, $p < .001$, $\eta^2 = .50$, whereby participants produced shorter responses to valid (*M* = 376) compared to invalid trials (*M* = 405).

As expected, the two-way interaction was found to be reliable, $F(1,46) = 4.57$, $p < .04$, $\eta^2 = .09$. Simple effects analysis confirmed that powerful (*M* = 389) participants generated shorter responses on invalid trials compared to control participants (*M* = 420) ($F(1,46) = 5.09$, $p < .03$, $\eta^2 = .10$). No difference between powerful and control participants emerged during valid trials $F(1,46) = 1.04$, $p < .31$, $\eta^2 = .02$.

1000 ms SOA

For the long SOA condition, a 2 (cue type: valid, invalid) x 2 (power: powerful, control) ANOVA, with power as the between-subjects variable, indicated a significant main effect of cue type, $F(1,46) = 28.62$, $p < .001$, $\eta^2 = .38$, with shorter responses to valid (M = 353) compared to invalid trials (M = 382). Consistent with our predictions, the Cue Type x Power interaction did not reach significance, $F(1,46) = 0.24$, $p = .63$, $\eta^2 = .005$.

Mood and self-efficacy

Mood scale items were combined into a single score ($\alpha = .75$, $M = .58$, $SD = .89$) as well as self-efficacy items ($\alpha = .71$, $M = 2.85$, $SD = .39$). An independent-samples *t* test revealed that power neither impacted participants' mood, $t(46) = -0.60$ $p = .55$ nor self-efficacy ratings ($t(46) = 0.75$, $p = .46$).

Discussion

The present study examined whether power affects the ability to orient attention across space. When the pre-cue correctly indicated the position of the target (i.e., valid trials) no differences were found between high power and control participants. By contrast, when the pre-cue was invalid and there was relatively little time (i.e. 500 ms) between cue offset and target onset to prepare and implement a response, power holders showed a temporal advantage. In contrast, at longer SOA (1000 ms), no differences emerged between high power and control participants on either valid or invalid trials. Post-test questionnaires confirmed that these effects could not be attributed to differences in positive affect or self-efficacy.

We suggest that power most affected performance during invalid trials because these required a greater degree of cognitive flexibility; individuals needed to ignore the cue and unexpectedly orient attention towards the opposite location. In line with this account, the effect was only evident at relatively short SOAs where participants had little time to prepare an appropriate response. At longer SOAs or on valid trials, the need for flexibility was lower which may explain why no effect was seen.

These effects may arise because power influences control needs and subsequently attention (Fiske, 1993; Guinote, 2007a). Individuals who find themselves in a powerful position benefit from increased resources and fewer constraints which in turn allow them to maintain their focus solely on the relevant aspects of the task at hand. They can therefore more flexibly utilize and control voluntary operations involving attention. On a cautionary note, we point out that additional empirical work is needed to understand the full spectrum of the effects of power on attention orienting. For example, one needs to know what the boundary conditions of the effects of power are, by examining the role of the proportion of valid and invalid trials in power holders' attention orienting.

More broadly, our findings build on those reported by Willis, Rodriguez-Bailon and Lupianez (2011) who showed that powerful individuals can make a better use of cues present in the environment to increase their executive control (see also Smith, et al., 2008). Their data support the idea that social power can impact rudimentary processes associated with spatial orienting and control.

From an ecological perspective, this is important because an advantage in the time taken to unexpectedly orient away from one stimulus towards another will speed decision-making and improve access to environmental resources. Facilitation in attention orienting may signal goal-related cues and benefit goal directed actions.

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Table 1

Response latencies (in milliseconds) on a spatial cueing task by SOA, trial and power (N = 48, Standard deviations in parentheses)

	500ms		1000ms	
	Valid	Invalid	Valid	Invalid
Powerful	370	389	351	376
	(48)	(56)	(41)	(70)
Control	383	420	355	386
	(39)	(48)	(37)	(52)

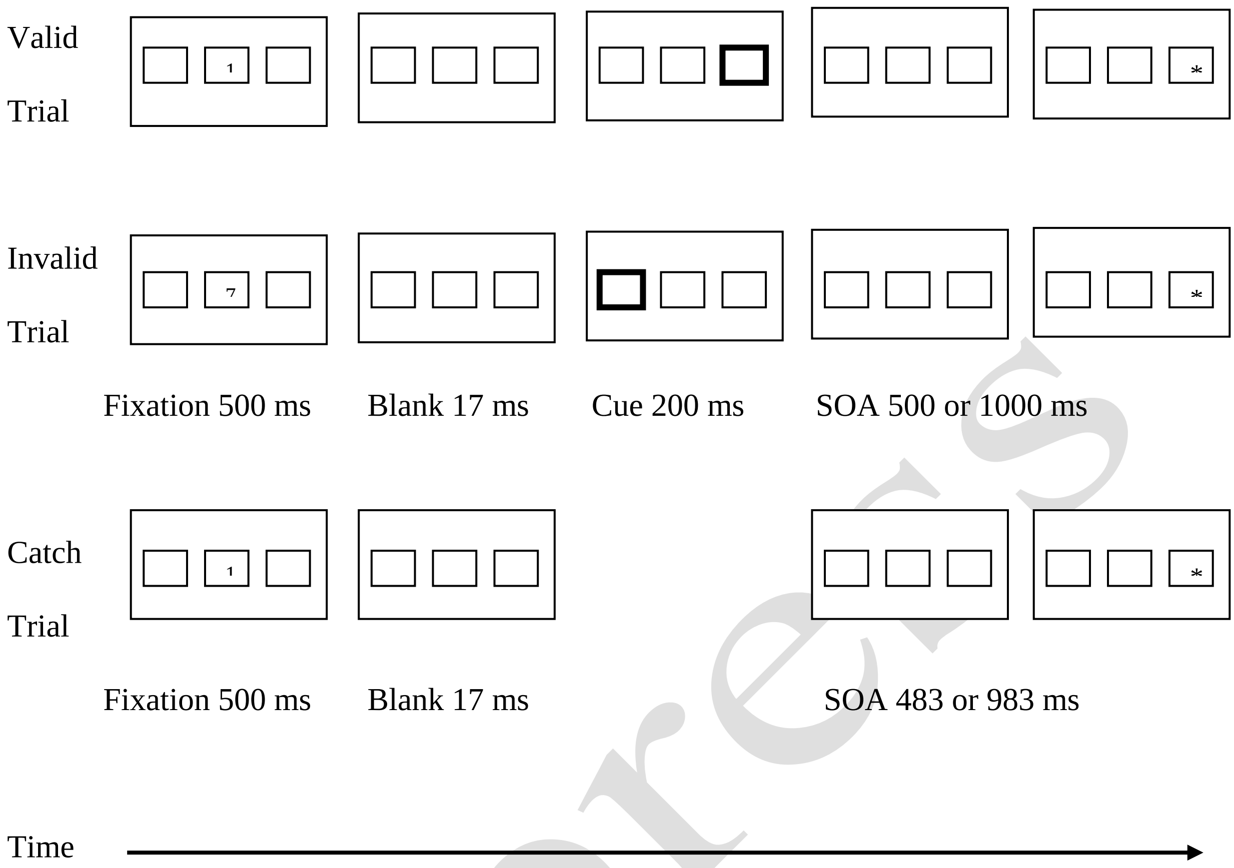

Figure 1. All stimuli appeared white on a black background. Displays consisted of three boxes (unfilled squares); one in the centre of the screen with the others positioned 8^0 to the left or right. The target appeared as an asterisk that subtended 1.2^0. Each trial consisted of a fixation digit presented for 500 ms; a blank interval of 17 ms; a cue (brightening of one of the boxes) for 200 ms; followed by a target (asterisk) presented after a stimulus onset asynchrony (SOA) of 500 or 1000 ms. The target remained in view until a response was made.